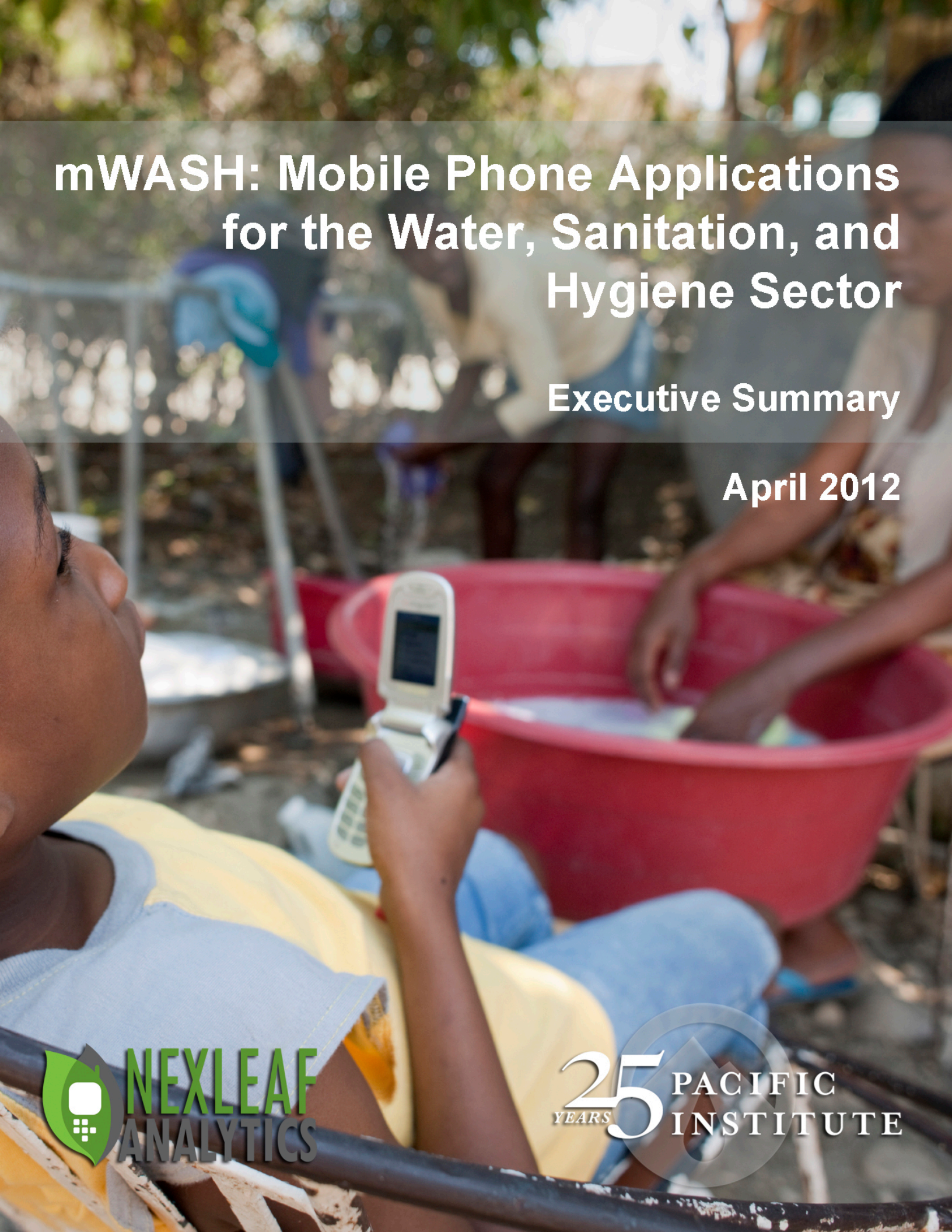

mWASH: Mobile Phone Applications for the Water, Sanitation, and Hygiene Sector

Executive Summary

April 2012

NEXLEAF ANALYTICS

25 YEARS PACIFIC INSTITUTE

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ISBN: 1-893790-39-8
ISBN 13: 978-1-893790-39-1

Cover Photo: Claudiad at istock.com
Photo Credit Page 14: Misha Hutchings/Pacific Institute 2012
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About the Pacific Institute

The Pacific Institute is one of the world's leading independent nonprofits conducting research and education to create a healthier planet and sustainable communities. Based in Oakland, California, we conduct interdisciplinary research and partner with stakeholders to produce solutions that advance environmental protection, economic development, and social equity — in California, nationally, and internationally. We work to change policy and find real-world solutions to problems like water shortages and habitat destruction. Since our founding in 1987, the Pacific Institute has become a locus for independent, innovative thinking that cuts across traditional areas of study, helping us make connections and bring opposing groups together. The result is effective, actionable solutions addressing issues in the fields of freshwater resources, climate change, environmental justice, and globalization.

About Nexleaf Analytics

Nexleaf Analytics is a nonprofit organization that aims to make mobile phone sensing technologies available to communities and organizations around the world. By combining the ubiquity of mobile networks with sophisticated server-side analytics, we are transforming regular mobile phones into leading-edge data-collection instruments. Nexleaf Analytics takes a revolutionary approach to collecting data on environment, climate change, and public health. Our platform includes mobile phone software, web portals for data analysis and visualization, and mechanisms to ensure system health and data integrity. More information on Nexleaf Analytics staff, directors, funders, and programs can be found at www.nexleaf.org.

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Acknowledgements

We would like to thank the USAID Development Grants Program and Cisco Foundation for their generous support for this project. Our deepest gratitude goes to the implementers of each of the ten case studies profiled in this report for sharing their experiences, expertise, and thoughts on creating best practices in the mobile phone for development and WASH sectors. We are grateful to the people who took time to review the report and provide comments: Ned Breslin, Michael Champanis, Anna Kydd, Farid Maruf, Josh Nesbit, Ari Olmos, Zarah Rahman, Ulrike Rivett, and Jeroen Verplanke. We thank Sandy Chang for her energetic support during the initial research. Nancy Ross and Paula Luu provided invaluable work on the final structure and format of this report, for which we are grateful. We would also like to thank our colleagues in PATTIRO whose dedication to improving governance in Indonesia has been inspirational. All errors in this report are the responsibility of the report authors.

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Glossary of Acronyms and Terms

API	application programming interface
application programming interface	a program designed to communicate information from one system of computing devices or programs to another system; Abbreviation: API
basic phone	a mobile phone that can make and receive voice calls to other phones and send SMS messages
feature phone	a basic phone with an additional feature such as a camera, but may include many features including mobile Internet access; smartphones are feature phones by definition, but feature phone is generally used to describe phones which are cheaper in price than smartphones, and sometimes with limited capabilities when compared to smartphones
general packet radio service	a telecommunications system providing fast internet connections for mobile phones; Abbreviation: GPRS
geocoding	the process of converting addresses into geographic coordinates which can be used to mark positions on digital maps
geographic information system	a system designed to capture, store, manipulate, analyze, manage, and present digitally all types of geographical data; Abbreviation: GIS
geotagging	the process of adding geographical identification data to various digital media such as SMS messages, photographs, video, websites, etc.
GIS	geographic information system
global positioning system	a global system of U.S. navigational satellites developed to provide precise location and time information for any location on or near the Earth; Abbreviation: GPS
GPRS	general packet radio service
GPS	global positioning system
ICT	information and communication technology

ICT 4D	information and communication technology for development
information and communication technology	any technology used to communicate, create, access, disseminate, store, manage, and manipulate information; indicates unified communications through computers, middleware, phones, mobile phones, and other devices, utilizing telecommunications (telephone lines and wireless signals) and necessary software; Abbreviation: ICT
information and communication technology for development	refers to an information and communication technology used for socioeconomic development; Abbreviation: ICT4D
interactive voice response	a telecommunications system that allows a computer to interact with humans through the use of a prerecorded database of voice messages to present options to a human user, and responses from either a user's voice or keypad touch tones (also known as DTMF or dual-tone multi-frequency) ; Abbreviation: IVR
IVR	interactive voice response
Java-enabled	can run applications based on the Java programming language
JavaROSA	an open-source platform for data collection on mobile devices that support Java-based programs
M4D	mobile phone for development; also mobile/mobile phone application/ mobile technology for development
mGovernance	mobile governance
mHealth	mobile health
mobile phone for development	also mobile, mobile phone application, or mobile technology for development; refers to using technologies related to mobile phones for socioeconomic development, is considered one type of ICT4D; Abbreviation: M4D
mobile governance	the practice of government functions through mobile devices, such as mobile phones and PDAs, for government-related services, data collection, communication, and information dissemination
mobile health	the practice of medical and public health through mobile devices, such as PDAs and mobile phones, for health services, data collection, treatment support, information dissemination, and so forth

mobile telemedicine	delivery of health related services and medical information via mobile communication technologies, see also mobile health
near field communication	a set of standards for smartphones and similar devices to establish radio communication with other smartphones, devices, tags, or microchips by touching them or bringing them very close together; Abbreviation: NFC
NFC	near field communication
PDA	personal digital assistant
peri-urban	describes a formerly rural area located on city outskirts that has urbanized with diverse multiple uses (residential, commercial, industrial, agricultural), or areas subject to urban sprawl; the term is used both in a qualitative sense (e.g. diffusion of urban lifestyle) and in a quantitative sense (e.g. new commercial and residential zones)
personal digital assistant	a handheld computer; Abbreviation: PDA
radio-frequency identification	a technology that uses electronic tags placed on objects, people, or animals to relay identifying information to an electronic reader by means of radio waves ; Abbreviation: RFID
RFID	radio-frequency identification
short message service	a form of communication on mobile phones that allows the exchange of short text messages between fixed line or mobile phone devices; Abbreviation: SMS
SIM	subscriber identity module
smartphone	a device that combines a mobile phone with a hand-held computer, and utilizes an operating system that can run applications for data storage, internet browsing, GPS, media players, etc. and communicate with other operating systems using APIs
SMS	short message service
subscriber identity module	a type of data storage for mobile devices, such as a SIM card for mobile phones and USB modems; Abbreviation: SIM
Voice over IP	a technology or set of standards for delivery of telephone calls and other voice communications over the Internet, involving conversion of analog voice signals to digital form; Abbreviation: ‘voIP’ or ‘VoIP’

Executive Summary

A large number of the billions of people who lack basic access to safe water and sanitation can count a mobile phone as one of their few possessions. Year after year, global and national institutions struggle to provide growing populations with basic water and sanitation needs, while mobile phones have become ubiquitous in the developing world. The spread of mobile phones has greatly reduced the time and cost of communication between multiple, often remote areas. Mobile phones are increasingly being used as cost-effective tools for collecting data and disseminating information. In the past decade, water and sanitation practitioners have begun deploying mobile phones as tools to improve water, sanitation, and hygiene (WASH) services. In studying the deployments of mobile phone for WASH, or mWASH, applications, this paper seeks to identify best practices and help inform future mWASH implementation for current and potential implementers of mobile phone solutions in the WASH sector.

WASH Sector Challenges and ICT Opportunities

The challenges in the WASH sector involve several complex and diverse problems. First, billions of the world's poor still lack access to basic water and sanitation services, as well as education about safe hygiene behaviors. Second, in regions where water and sanitation services are being extended, projects have a high failure rate. Third, even where formal water supply and sanitation services exist, the service is often unreliable and of poor quality. Fourth, water systems everywhere face long-term sustainability threats from over-extraction, climate change, urbanization, and pollution. Many experts have argued that overcoming these varied challenges in the WASH sector requires a focus on governance, since good governance requires a wide range of institutions and non-state actors involved in different or overlapping aspects of water, sanitation, and hygiene to manage resources and demand better services and accountability (Allison 2002; Plummer and Slaymaker 2007; UNDP Water Governance Facility 2009).

Each of these challenges could be addressed through more information, as well as better use of information by stakeholders. Information could be used to demonstrate need, monitor progress, and compel better governance and planning (WaterAid 2011). For instance, the urban and rural poor often have no way to advocate for their basic needs for water and sanitation because their problems are invisible to higher levels of planning and policymaking. Funders and WASH NGOs often do not have the resources to track continued functioning of their projects once they are built and handed over to communities. Water utilities and governments often lack information on the specific needs of the populations they serve, and are not held accountable for planning and budgeting decisions. All of these actors lack information on the state of water resources—both in terms of water quantity and quality. In the absence of a "single water manager," there is no one place for information to be collected or shared in ways that can promote better management of water supply and over-extraction results.

Collecting, aggregating, and analyzing data from remote regions and making the data available in a transparent way can help identify where investments are most urgently needed and can improve the long-term project monitoring. It can also contribute to better water resources planning. Information and communications technologies (ICTs) have the potential to address these

information gaps in the WASH sector by transforming the way data is generated, communicated, and shared. Mobile phones are already being used as tools for data collection and dissemination across multiple sectors, such as health, socio-economic development, agriculture, natural resource management, and disaster relief (Hellstrom 2010; UNICEF 2010).

Mobile Phone System Design

Effective mobile phone solutions must be customized to address the different information needs of different change agents—NGOs, residents, utilities, research institutions, local governments—in a useful format in order to assist in addressing specific governance problems.

In developing mobile phone for WASH (mWASH) applications, three aspects can be considered in solution design: the way the application will function given social context and information needs (social design); the appropriateness of the technology platform to meet information needs (technical design); and the aspects that ensure an effective support structure for longevity and sustainability of the application (program design).

Social design involves two types of considerations: first, deciding how to recruit and engage users to ensure the system is scalable and sustainable in the long-term, and second, ensuring that the collected data is accessed and used by the audiences for which it was intended. This could be achieved by considering aspects such as partnerships with the government, via direct peer-to-peer interactions between users, or crowdsourcing data to create public information that could be used by media outlets, NGOs, or service providers.

There is a range of technical design options for data collection and dissemination. Data collection or input options include: simple SMS (short message service) data entry, interactive SMS, native forms on basic phones, smartphone applications, interactive voice response (IVR), and geolocation features. Each method involves particular opportunities and challenges for different social contexts. The options for data dissemination or output include: web-based dashboards, web-based mapping, broadcasting or bulk SMS, interactive communication, simple SMS, and other reports and data formats like interactive graphics, photos, or videos.

Finally, there is a need for effective design of the supporting program that ensures the system can be sustained and updated in response to the changing needs of its users and as technology evolves and improves.

Review of Mobile Phone Solutions

In order to learn more about existing efforts to use mobile phones for public services, we reviewed the options for social, technical, and program design and examined cases for how some of these options might impact how mobile phone applications will perform as information interventions in various contexts. We conducted a global survey and identified over forty mobile phone projects worldwide. From this list we selected ten organizations and their projects for further study, including AppLab Indonesia; e-Pasar Ikan (Fish Marketing Information System); FLOW; Human Sensor Web; Jana (formerly txteagle); Maji Matone; NextDrop; SHM Foundation; Water Quality Reporter; and Yayasan AirPutih. We interviewed each organization to understand key decision points on social, technical, and program design and develop key principles for the success of mobile phone applications relevant to WASH.

Designing Successful Mobile Phone Efforts in WASH

We aimed to capture a snapshot of mobile phone applications in development in general—and in wash, sanitation, and hygiene in particular. Mobile phone applications are powerful mechanisms for achieving or supporting the achievement of development goals. Through this study, we identified key elements that were critical to the success of the mobile phone case study projects.

Our review suggested that several elements were critical in the design of mobile phone solutions:

Considerations for User Participation and Experience	
Understand the Socio-Cultural Context	While it is not always easy to anticipate challenges based in a specific socio-cultural context, documented successes and challenges of others can help future projects to prepare for issues such as: differences in mobile phone access and usage individually and as part of a household; rigid attitudes and expectations about government action; preferred mode of communication; and prohibitive fears and concerns.
Build the User Base Through Well-Planned Outreach To Achieve Uptake	Outreach is important for user uptake of the system, both during project development and implementation.
Ensure the System is Easy to Use	The success of a system and level of user participation depended heavily on technical accessibility in the data collection step (which was the user's first, and sometimes only, interface with the system), and relevant output formats in data dissemination and analytics.
Fulfill a Key Need--Monetary Incentives are Not Necessary	Compensation was not needed when the user received a direct benefit from submitting data, such as improvements to service provision.
Use of the Data	
Implement and Promote User Access to Data	A key opportunity is missed when users do not have access to the same data as the agencies they are trying to hold accountable for making improvements.
Ensure Government Agency or Service Provider Responds to Reports	Low expectations of government services based on prior unresponsiveness created a lack of motivation for users to report issues at all. Service providers and government agencies can gain the trust of their customers and constituents through timely acknowledgement and response to reports, even when a solution is not immediately possible.
Use Verification Options to Create High-Quality Data	Mobile phone applications have the potential to improve the quality and quantity of data that is collected in the long term. They can help to make manual data transfer more efficient, reduce manual data errors, and increase the frequency of monitoring due to relative cost effectiveness. Multiple manual and automated options exist to verify data.

Plans for Success and Sustainability	
Identify and Measure Indicators of Short and Long-Term Success; Use This Information to Refine System Design	Interestingly, most of the case study projects—information interventions to empower through the collection or dissemination of data—did not develop and track a variety of metrics of effectiveness that would help them to understand how different social, technical and program design factors might have impacted their success in the short and long term. Project performance and evaluation data has the potential to help understand and overcome short-term issues, but also to serve as factual proof of the need for and relevance of the system—powerful components when seeking funding.
Secure a Future for the System through a Plan for Long-Term Sustainability	Implementers risk failing their beneficiaries when they can't keep a system running due to lack of funding. Some cases showed that mobile phone solutions can be sustained with strategies such as ensuring key user-stakeholders invest in maintaining the project (e.g., local governments) or leveraging technical partners to relieve some of the burden of developing, acquiring, and maintaining software or hardware.

Looking Forward

While the key lessons from this study are meant to help guide careful consideration of factors and options that can impact the success of a mobile phone solution, such projects focused on achieving improvements in water, sanitation, and hygiene should take particular caution in focusing on the short term.

We have identified four broad categories of problems in water, sanitation, and hygiene, with the majority of the mWASH projects in the broad survey dealing with issues of access, failure, or breakdown and service unreliability. The untapped potential remains in use of these systems for long-term monitoring and planning. To make improvements in governance, substantial information is needed and must be put to effective use. Mobile phone solutions hold the greatest potential for amassing data quickly and thoroughly directly from the underserved populations who are most in need.

Globally, mobile phone solutions are proliferating rapidly in many regions, fueled by desires to bring effective change quickly. Sustained success in these emerging projects will be dependent on effective program management, attention to the financial and technical sustainability of the system, and monitoring and adaptively managing for system effectiveness in the short and long term.